

WHAT IS CLAIMED IS

1. An ultraviolet-light radiating apparatus for radiating ultraviolet light to a film to be processed on a substrate, comprising:
5 first ultraviolet-light radiating units for radiating ultraviolet light having a wavelength of 200 nm or shorter; and second ultraviolet-light radiating units for radiating ultraviolet light having a wavelength longer than 200 nm.

10 2. The ultraviolet-light radiating apparatus according to claim 1, further comprising a storage unit for accommodating the first and second ultraviolet-light radiating units and having a light-transmitting window facing the film, wherein the storage unit is filled with an inert gas.

15 3. The ultraviolet-light radiating apparatus according to claim 1, wherein the second ultraviolet-light radiating units radiate the ultraviolet light having energy higher than binding energy of constituent molecules of the film.

20 4. A wet etching apparatus comprising:
a stage for holding a substrate having a film to be etched;
first ultraviolet radiating units for radiating ultraviolet light having a wavelength of 200 nm or shorter to the film;
25 a chemical-solution coating unit for coating a chemical solution on the film; and
second ultraviolet radiating units for radiating ultraviolet light having a wavelength longer than 200 nm to the film through the chemical solution.

30 5. The etching apparatus according to claim 4, wherein the stage holds substrate in an atmosphere containing oxygen.

6. The etching apparatus according to claim 4, wherein the second
ultraviolet radiating units radiate the ultraviolet light having
energy higher than binding energy of constituent molecules of the
5 film.

7. A wet etching method comprising:
radiating first ultraviolet light having a wavelength of 200
nm or shorter to a film to be etched on a substrate;
10 coating a chemical solution on the film after radiating the first
ultraviolet light; and
radiating second ultraviolet light having a wavelength longer
than 200 nm to the film through the chemical solution.

8. The wet etching method according to claim 7, wherein the
15 first ultraviolet light is radiated to the film in atmosphere
containing oxygen to generate oxygen radicals and ozone gas in vicinity
of the film.

9. The wet etching method according to claim 8, wherein an organic
20 coating formed on a surface of the film is removed by the oxygen radicals
and ozone gas.

10. The wet etching method according to claim 7, wherein the
25 second ultraviolet light having energy higher than binding energy
of constituent molecules of the film is radiated.

11. A method of manufacturing a semiconductor device,
comprising:
30 forming a high-k dielectric film on a substrate;
forming a gate electrode on the high-k dielectric film;

radiating first ultraviolet light having a wavelength of 200 nm or shorter to the high-k dielectric film;

coating a chemical solution on the high-k dielectric film after radiating the first ultraviolet light;

5 radiating second ultraviolet light having a wavelength longer than 200 nm to the high-k dielectric film through the chemical solution; and

forming diffusion regions in the substrate after radiating the second ultraviolet light.

10

12. The method of manufacturing a semiconductor device according to claim 11, wherein the first ultraviolet light is radiated to the high-k dielectric film in atmosphere containing oxygen to generate oxygen radicals and ozone gas in vicinity of the high-k dielectric film.

15

13. The method of manufacturing a semiconductor device according to claim 12, wherein an organic coating formed on a surface of the high-k dielectric film is removed by the oxygen radicals and ozone gas.

20

14. The method of manufacturing a semiconductor device according to claim 11, wherein the second ultraviolet light having energy higher than binding energy of constituent molecules of the high-k dielectric film is radiated.

25